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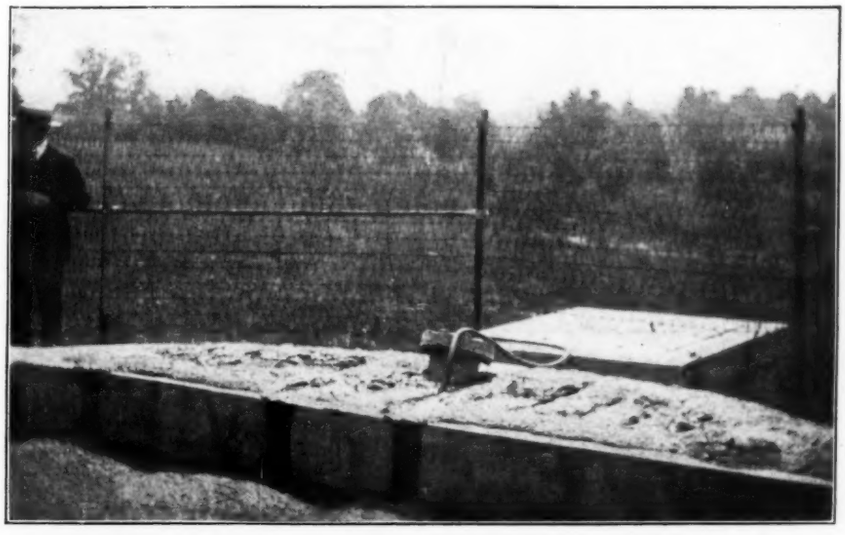

SEGMENT GAS VENT FOAMING IN IMHOFF TANK AT OAKLYN, N. J.

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CITY COUNTY STATE

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Sewage Treatment in Imhoff Tanks

By Russell Riker *

Separate digestion of sewage sludge in two-story or Imhoff tanks. Experiences with thirty-seven such tanks in New Jersey, and conclusions of the State Department of Health as to certain advantages and disadvantages of such tanks.

NOTE: Most of the information and data contained herein are derived from small plants such as the New Jersey municipalities construct.

In New Jersey there are (1921) thirty-seven Imhoff installations serving thirty-three municipalities, five institutions and three corporations. Large installations of two-story tanks have been constructed in the following cities: Albany, Rochester, Worcester, Atlanta, Baltimore, Columbus, and Schenectady. Table No. 1 shows the rapid growth in population served by this type of tank in the State from 1913 to 1922. The considerable increase between 1917 and 1918 is due to the construction of the Plainfield sewage tank, which is at present the largest installation in this state.

This table also gives a comparison between the number of one-story and two-story tanks constructed in New Jersey since 1911. The ten army one-story tanks constructed in 1918 have not been included. The alarming factor in this comparison is the great increase in the two-story tank during the last few years as compared with those figures of the one-story tank.

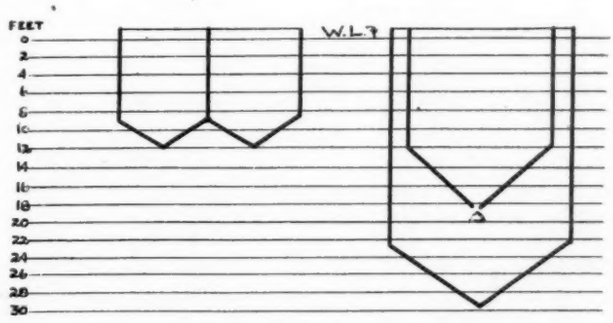
The two-story tanks are costly to construct, due principally to their necessary greater depths. Then there is an added cost due to the royalty fee based upon population to be served and ranging in amount from $10 for one hundred population to $15,000 for two million population. Municipalities are particularly interested in the cost, both initial and operating, as they gain no direct revenue from treatment plants. The state is interested in the degree of purification secured in the operation of the plant.

The operating expense also is high. At Plainfield, where the sprinkling filters follow tank treatment, it is estimated that two-thirds of the total operating cost is expended on the Imhoff tanks. Here the total cost in 1919 for the Imhoff tank was $6,699.38, or $5.50 per million gallons of sewage. The estimated cost of operation for the smaller plants ranges from $2.00 to $15.00 per million gallons of sewage, averaging about $5.00 per million gallons.

Recently an engineer, who had just returned from Germany, stated that the construction of Imhoff tanks in that country had about ceased due to the unsatisfactory results obtained in operation and that several municipalities were being sued because of nuisances

Table No. 1—Population Served by Imhoff Tanks and Number of Tanks in New Jersey, 1911 to 1921

Year	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
Population	7,000	9,000	12,500	36,000	41,000	44,000	52,000	84,000	91,000	100,000	104,000
Number of Imhoff tanks.	1	2	6	12	15	18	23	24	26	34	37
No. of single-story tanks.	8	12	17	23	32	35	40	42	43	44	45



COMPARATIVE EXCAVATION DEPTHS OF SINGLE-STORY AND IMHOFF TANKS WITH EQUAL SETTLING CAPACITY

*Assistant Sanitary Engineer, Dept. of Health of New Jersey.

due to odors. He further stated that separate sludge digestion of sewage was still being followed in Germany, but that it was carried out by other means than Imhoff tanks.

The first Imhoff tank in New Jersey and one of the first in the country was constructed at Chatham in 1911. This installation of 300,000 gallons capacity serves jointly the municipalities of Chatham and Madison. Dr. Imhoff was in this country at this time and personally inspected and approved the plans and construction of the tanks. It is interesting to note that they were designed with a tight concrete cover, indicating that Dr. Imhoff was of the impression that it would not be necessary to remove scum from the surfaces of the tanks and this impression is still left with the officials of the municipalities by many consulting engineers. For nearly a year it was impossible to watch the action in the tank at Chatham, but evidence of the foam and sludge having worked itself into and over the gas vents could be seen when the concrete cover was removed, which was necessary when the effluent became so charged with suspended solids as to interfere with the satisfactory operation of the plant.

FOAMING

Foaming is the basis of poor operating results. It may cause floating sludge and scum to overflow the top of the gas vents into the settling compartment, or it may fill the gas transition chamber or the gas vents with foam and floating sludge so as to force such material up through the slot from beneath. This phenomenon has been described in numerous engineering journals. The best practical comments can be found in the engineering journals under articles upon the operation, by the operators of the plants at Fitchburg, Atlanta, Columbus and Schenectady.

Our experience leads us to agree with the opinion of the Columbus operator, that the same bacteriological action occurs both in the one-story and two-story tank. In this state practically every single-story tank in operation has from one to six feet of scum on the surface with very little sludge in the bottom and the top level of scum is always several inches higher than the water line. The small gas vents of the two-story tank makes the ebbullition of gas and sludge more pronounced, however, than in the one-story tank,

The theoretical cause of foaming, as advanced by chemists, bacteriologists and sanitary engineers, is the predominance of the ordinary bacterial decomposition over enzyme action or liquefaction. Ordinary bacterial decomposition results in the production of excessive sulphurous gases which are not entirely absorbed by the surrounding liquid. How to secure a proper balance between enzyme liquefaction and bacterial decomposition, with a predominance of the former, has never been discovered. Foaming occurs in all types of two-story tanks and it may occur with all or any character of sewage, although it has been found less noticeable with stale sewage.

Table No. 2—Data on Design of the Largest Imhoff Tanks in the United States

Municipality	Capacity, million gals. per day	Total Depth, in feet	Percentage Area of Gas Vents to Settling Area	Detention Period, hours	Sludge Storage, cu. ft. per capita	Slot Size, inches	Sludge Bed Area, sq. ft. per capita
Albany	30	27	4.75	3	1.7	8	.44
Atlanta							
Plant No. 1....	3	25	4	3	1.7	6	.39
Plant No. 2....	5		8				
Plant No. 3....	8		8				
Baltimore	14	26	18	2	1.0	8	.5
Columbus	35	27	9	1.7	1.2	8	.38
Rochester							
Plant No. 1....	55	40	34	1.5	2.0	6	.33
Plant No. 2....	2	23	12	2.5	1.84	6	.33
Schenectady	8	21	20	1.5	0.75	6	

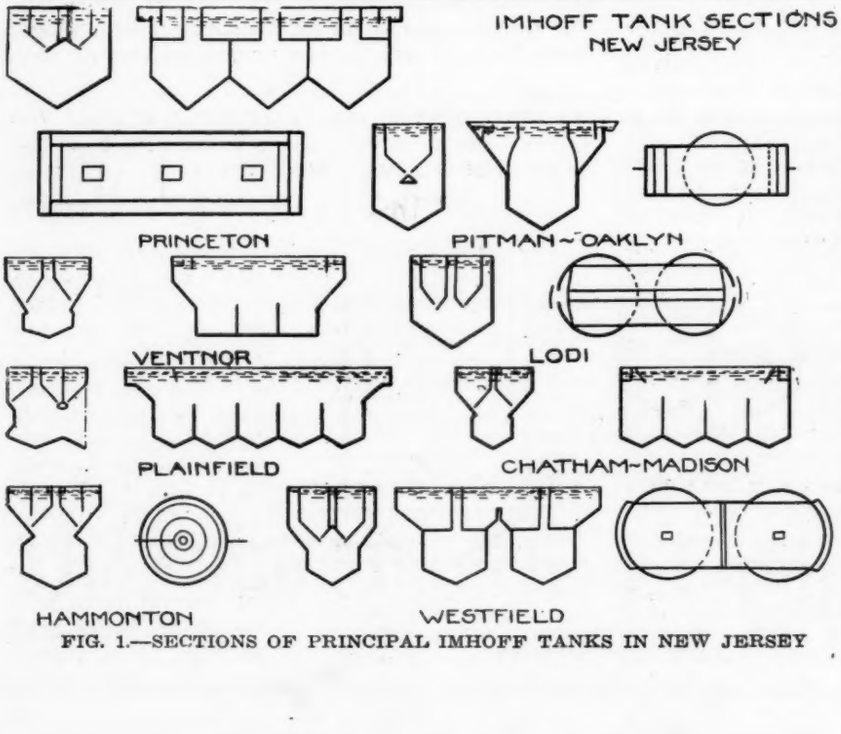


FIG. 1.—SECTIONS OF PRINCIPAL IMHOFF TANKS IN NEW JERSEY

DESIGNS OF IMHOFF TANKS

Table No. 2 gives a list of the larger Imhoff tanks constructed in this country, with the unit size for which the tanks were designed. The depth ranges from 21 feet to 40 feet, the gas vent area from less than 5% to 34%, the detention period from one-half to three hours, the sludge storage capacity from .75 cubic foot per capita to 2.0, the sludge bed area from 0.3 to 0.5 square

foot per capita. The dimensions of these tanks were obtained from various periodicals.

Table No. 3 indicates the unit sizes used in the design of two-story tanks in New Jersey. These are small installations treating characteristic domestic sewage with the exception of a few which treat a small percentage of trade wastes. This list does not include all the two-story tanks but only those which have been given sufficient operating attention to determine with what degree of success they are working.

Table No. 3—Imhoff Tank Unit Dimensions, New Jersey Tanks

Municipality	No. of tanks	Capacity designed for, gallons per day	Inside dimensions, feet, L. W. D.	Percentage area of gas vents to settling area	Size of slot	Sludge Capacity cu. ft. per capita	Detention period, in hours	Operation begun	Sludge beds, sq.ft. per capita	Floating scum depth	Sludge pipe size	Per cent. of Sewage Domestic
Chatham-Madison	2	340,000	50 x 14 x 12	5.4	6"	1.3	2	1911	.6	5'	8"	100
Fairview	2	400,000	30 Diam. x 18	10	6"	1.0	2.8	1915	.62	..	..	90
Hammonton	1	250,000	33 Diam. x 27	4.5	9"	.75	2.75	1915	..	11'	8"	80
Lodi	3	500,000	60 x 25 x 30	10	6"	1.8	1.5	1920	0.25	14'	8"	80
Oaklyn	1	168,000	30 x 12 x 24	10	6"	1.1	2	1917	.35	8'	8"	100
Pitman No. 1.....	1	300,000	40 x 21 x 22	26	6"	1.5	2.5	1917	.2	7'	8"	100
Pitman No. 2.....	1	100,000	30 x 12 x 24	10	6"	1.9	2	1918	..	10'	8"	60
Plainfield	6	3,000,000	65 x 35 x 20	13	6"	1.2	1.5	1916	..	..	..	90
Princeton	1	300,000	54 x 28 x 20	48	6"	1	2.5	1914	1	9'	..	100
River Edge	1	75,000	25 Diam. x 17	4	10"	1	2.5	1918	1	5'	8"	100
Roebling	1	350,000	50 x 25 x 21	10	8"	1.5	2.5	1921	1.0	8.5'	6"	100
Skillman	1	300,000	43 x 22 x 16	40	..	..	2	1919	.8	7'	8"	100
Ventnor	3	600,000	41 x 18 x 22	13	6"	1.5	4	1916	.16	13'	6"	100
Washington	1	200,000	40 x 14 x 23	44	6"	1.0	2	1919	1.4	7'	6"	80
Westfield	1	600,000	70 x 35 x 26	6	6"	.7	2	1915	0.3	16'	8"	90

Fig. No. 1 gives the sectional views of the principal Imhoff tanks in the state.

Screens: Coarse screens were advised by Dr. Imhoff and were installed at the Chatham-Madison plant, but the superintendent has since removed the screens and advises against installing them. It may be that with the character of the sewage at the Chatham-Madison plant screens are not necessary, but it is though advisable to install screens previous to Imhoff tanks provided these screens will be well taken care of. Screens neglected usually cause a nuisance and are better left out unless there is an attendant at the plant who can be relied upon to clean them frequently. One of the simplest and best operating screens is the type installed at Freehold which is similar to that at Baltimore, Md. The screen is placed at an angle parallel to the line of flow and not perpendicular as is usually the cause. Fine screens of the Reinsch-Wurl type have been installed at Plainfield previous to Imhoff tank treatment and the operator claims that they assist in the operation of the plant.

Grit Chambers: A grit chamber should be installed previous to tank treatment, principally to remove the foreign mineral solids which are found even in a separate system. The material, especially sand, should not be allowed to enter the tank, as it fills the hopper bottoms of the sludge digestion chamber and makes impossible the drawing of the sludge.

Grease Traps: Although grease interferes with the proper digestion of sewage sludge more than any other constitutent, no satisfactory grease trap has been designed to remove it from the domestic sewage at the treatment plant. Its specific gravity is so much lower than the water that when it is mixed with other organic matter it tends to cause it to float. Much of the objectionable odors at sewage treatment plants are caused by the nauseating odor of grease, digestion of which is difficult. It is a common occurrence to discharge good digested sludge from a settling tank with patches of grease balls. The sludge will have practically no odor until the grease balls appear and then the odor is very objectionable. Grease traps installed as one of the units at the sewage treatment plants for army cantonments during 1917 and 1918 were failures. In the army traps when the grease did come to the top, the putrescible organic matter would settle to the bottom and become septic, later rising to the top and mixing with the grease. This happened particularly during the time of minimum flow. The army solved the grease problem by installing grease traps on the kitchen drain of each mess hall so as to prevent the grease from mixing with the toilet wastes. To aid in the treatment of sewage it is suggested that whenever possible grease traps be installed on the kitchen drains from hotels, hospitals and institutions.

Pumps: Pumping the sewage has somewhat the same effect on the suspended matter as fine screens. Breaking it up assists considerably in the digestion of the suspended matter.

Inside Dimensions: The width of the tanks designed in New Jersey ranges from 12 to 35 feet, the length from 30 to 70 feet and the depth from 12 to 30 feet; an average ratio of width to length of 1 to 2. This ration can be made larger but if the length is made longer care must be taken that the cross-section of the settling tank be such as to keep down the velocity of the sewage. Dr. Imhoff recommends that the tank be as deep as possible, explaining that the fresh sewage mixes better with the digested sludge and thus gives a greater rapidity of decomposition. Experience in New Jersey does not indicate that the advantages in operation gained by building deep tanks warrants the increased cost of construction. No doubt there is a greater rapidity of gas ebullition in the deep tanks,

resulting in better agitation, but there is no indication that the deeper tanks, all other conditions being the same, are working better in this state than the shallow ones.

Type of Tank: Imhoff tanks may be of four types; longitudinal horizontal; radial horizontal; downward and upward and radial horizontal flow. Of these, the longitudinal horizontal is the most common. It is easier to construct and gives as good efficiency as the others.

Number of Tanks: If the flow is greater than one-half million gallons per twenty-four hours, more than one tank is usually constructed. Experience would indicate that it is better to have two tanks, even if the flow is less than one-half million gallons per day, so that if trouble, such as foaming, is encountered with one tank it can be shut off and allowed to rest for a short period.

Inlets and Outlets: The practice of reversing the direction of flow in Imhoff tanks makes it necessary that separate inlets and outlets be constructed at each end, or that a weir be constructed at each end to act as both inlet and outlet. In the latter case both weirs must be at the same elevation and great care must be taken to design the channels so as to give proper velocity during the minimum period of sewage flow, in order to prevent sedimentation in the influent channels. In either design care must be taken to distribute the flow equally to each tank. The proper distribution of solids, as well as the quantity of sewage, is also very important for in some cases one tank has been known to take more of the floating material and larger solids, resulting in a poor sludge digestion. Interesting experiments carried on at Plainfield by the operator, John R. Downes, and Prof. Earl B. Phelps, indicate that with three tanks in operation the tank farthest away from where the sewage entered received by far the greatest quantity of sewage.

Operators are more favorably disposed toward separate inlets and outlets. In fact, in some instances separate inlets have been constructed after the plants were placed in operation. Of the larger plants outside of the state, Schenectady has recently placed separate inlets which will allow the sewage to enter the settling chamber just beneath the channels. The effluent weir should be so designed as to increase the velocity as little as possible.

To be continued

River and Harbor Appropriations

Major General Beach, chief of the army engineers, in his annual report recommends the expenditure during the next fiscal year of approximately $11,000,000 for rivers and harbors in 11 southern states, exclusive of $7,500,000 for the Muscle Shoals project in the Tennessee river and $6,670,000 for the Mississippi river commission flood control. The aggregate amounts to about one-fourth of the sum recommended for the entire country. The harbor projects call for $1,025,000 for Savannah and for sums varying from $48,500 to $588,000 for nine other ports. For the southwest pass of the Mississippi river $1,136,000, and four other waterway projects appropriations of from $100,000 to $400,000.

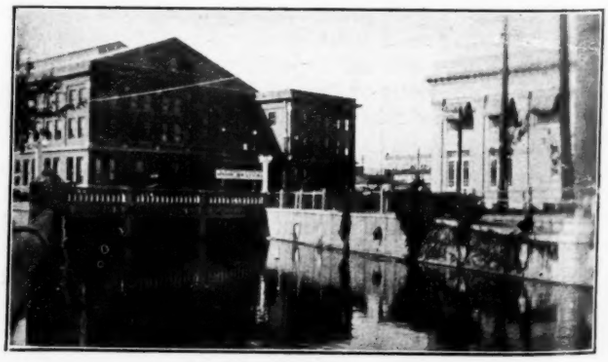
Ornamenting an Intra-Mural Creek

A creek flowing through Hutchinson, Kan., is confined between retaining walls that are provided with boxes in which are grown vines that cover the wall. An overflow channel has been carried around the city to protect it from floods.

Like many other cities, Hutchinson, Kansas, lies on both sides of a stream which, flowing through its business center, as well as the residence section, offers several difficulties in the way of street location and construction. In addition to this, as is generally the case, it was found almost impossible to prevent the use of the banks and the stream itself for deposits of all kinds of rubbish. In addition to the matter of appearance and interference with street location the creek occasionally, in times of floods, overflows its banks and floods buildings adjacent to it.

In order to remedy these conditions the city excavated a canal around its southern border connecting with the creek at the two extremities of the town and placed flood gates in the canal so that, in times of high water, the surplus flood could be carried around the town through the canal. The portion of the canal passing through the town was confined between two

FLOWER BOXES ARE PLACED JUST ABOVE THE WATER LEVEL AT EVERY THIRD POST
Some of the vines have started growing.



WHERE THE CREEK PASSES UNDER THE CONVENTION HALL
Parts of the wall and fence at the extreme right are seen to be covered by the vines.

concrete walls, the walls and the grading behind them being carried up to street level. Along some parts of the creek a street separates it from the buildings, while in other cases the creek passes along the rear of or under buildings, some of which use the wall as a part of their foundations. In the business center of the town the creek has been entirely covered over, passing under streets and buildings entirely out of sight.

A unique feature of this wall is that there were constructed along it flower boxes, cast integral with the wall and located just above water level. In these boxes have been planted vines with a view to having them gradually cover the wall to a large extent and relieve the monotonous appearance of the concrete surface. Already the vines have taken a good start, and add greatly to the appearance of the waterway.

Piping Streets Before Paving

The problem of deciding to what extent water, gas and sewer mains, and house connections made with them, should be constructed in a street before paving is done on it was discussed at length before the twenty-third convention of the League of California Municipalities. The discussion was opened by J. A. Griffin, city engineer of Los Angeles, who stated that the first judgment of any engineer would probably be that all pipes should be laid before paving. He referred to the practice which he understood obtained in certain eastern cities of refusing permission to cut into a pavement for ten years after it was laid, which, he stated, would be entirely out of the question in the case of a city growing as rapidly as Los Angeles, where it is almost impossible to keep up with the immediate demands for mains and connections without thinking of anticipating future needs. During the nine months previous to the convention 30,241 trenches had been cut in the streets of Los Angeles, and 90 men with 7 trucks and 11 road rollers found it impossible to put back the trenches as fast as they were cut, and Mr. Griffin stated that he was running behind at the rate of 60 trenches a day.

This, however, is not an argument against a preconstruction of mains and connections in ordinary cases. More important is the fact that, in a new city or one growing as rapidly as Los Angeles, it is impossible for engineer, city planner or any one to foresee ten years in advance just what the development will be, what direction it will take and what size of main or sewer will be required for that particular street.

Perhaps even more important an argument against pre-construction is the large amount of capital that is tied up. Some water or gas companies, if required to extend their mains sufficient to cover ten years' future growth, would find this making such a drain upon their capital that they would almost have to go out of business, while the interest on the non-productive capital thus buried in the ground would be sufficient to pay a fair dividend to the stockholders or would add considerable to the rates which the company must charge its customers.

If the company or city requires the property owner to pay for the house connection, holders of undeveloped property are burdened with a cost which may, in some cases, ruin the real estate investor or require him to sell the property at a loss. Mr. Griffin did believe, however, that the company or owner should be required to put in all pipes or connections required for two years or so in advance, believing that it would be possible to visualize that far ahead.

Another matter that was brought up in the discussion was the fact that the blind-end or dead-end connections were very apt to rust out by standing idle. Mr. Monroe, of San Diego, stated that in that city such services rusted out in nine months in some cases, while in other parts of the city they would stand for 15 or 20 years.

Marston Campbell, of Oakland, stated that some years ago he put in two miles of sewers in Honolulu and ran connections 25 feet each way to the property lines in front of all lots that were not built up. "Today not one in ten of these connections are used, and that street is entirely built up. In other words, we put thousands of dollars of work under the ground that is absolutely useless today because no one can tell just where the laterals will be required until the property is built up."

As to the matter of cost, Mr. Stranahan, of Fresno, stated that he had arranged that the water company should be notified of proposed paving as soon as the resolution for the work had been passed, because neither a city nor a water company can, in a few minutes, plan the mains most suitable for a given street or obtain the money or material for constructing them. In many cases there is no difficulty in showing the company that it would be cheaper and better for them to lay the mains before paving, for since they are required to pay all expenses of repaving any paved street which they have cut into they will find themselves economically justified in putting in pipe lines and connections in advance of the pavement.

Most of the speakers seemed to agree that it was impossible to prevent companies or municipal departments from opening up pavements for laying sewers and water mains, although it is possible to limit this by planning sufficiently far ahead and notifying the companies or departments concerned.

There seemed to be general agreement that the best solution of the problem was to provide alleys in all parts of the cities and require the underground mains to be laid in these alleys. In Fresno new subdivisions are required to have alleys for public utilities, and the same is true of Fullerton.

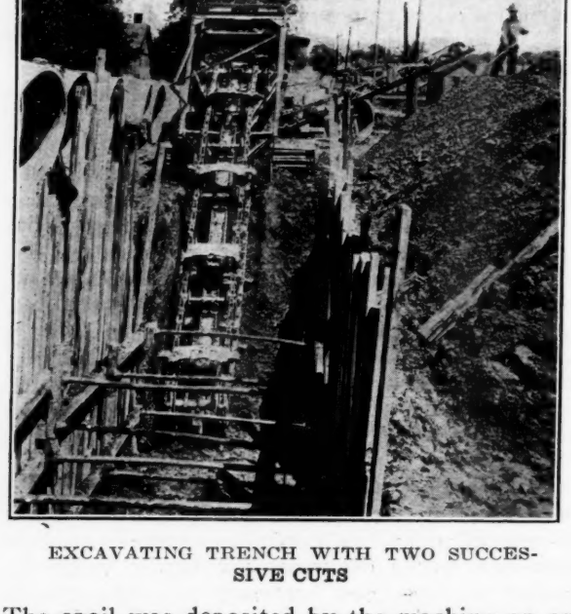
Mulcting the Water Department

The Cincinnati council passed an ordinance recently authorizing the transferring, at the end of each month, of the surplus funds of the Water Department to the general fund of the city. It is proposed to increase the water rates and use the department as a source of public profit.

There is, however, question as to the right of the city to use the revenues of the department for other than departmental purposes, and Mayor Carrel has announced that about the middle of February a suit would be filed to settle this point.

Two-Cut Machine Trench Excavation

A deep trench of a greater width than that of the available excavating machine was recently dug at Muncie, Ind., where the machine was operated twice, each time making a maximum width cut of 54 inches to the depth, also maximum, of 20 feet and thus securing a trench 108 inches wide that was sheeted with vertical boards as the work progressed. The vertical boards were braced by adjustable screw braces that engaged two or more tiers of waling pieces.



EXCAVATING TRENCH WITH TWO SUCCESSIVE CUTS

The spoil was deposited by the machine on one side of the trench while the precast concrete pipe to be laid in the trench was delivered on the opposite side without interfering with continuous operations. The trench was excavated at the rate of 266 linear feet per 10-hour day, handling the earth at the rate of 80 cubic feet per minute and at a cost of 5.2 cents per cubic foot. The work was done by the Harris-Andrews-Henderson Co., Youngstown, Ohio, with an Austin trenching machine operated by a 100-h.p. gasoline engine.

Building Concrete Pier on Hard Rock Bottom

In the construction of a reinforced concrete pile pier in an exposed position where the water had a minimum depth of 23 feet at Manila, P. I., holes 2 inches in diameter at the bottom were drilled 13 feet into hard volcanic rock and enlarged by blasting to receive precast piles 18 inches in diameter.

The piles were braced above water level by reinforced horizontal and diagonal struts cast in place with their reinforcement rods clamped to the piles and the connections thoroughly protected by concrete jackets with reinforcements secured by the pile clamps. The drill bits were protected by pipe casings inserted 18 inches into the rock in holes made by expansion bits operated inside the casings. The pier was designed to resist heavy wave action and the reinforcement steel was thoroughly protected with extra thick rich concrete.

New London Turnpike II*

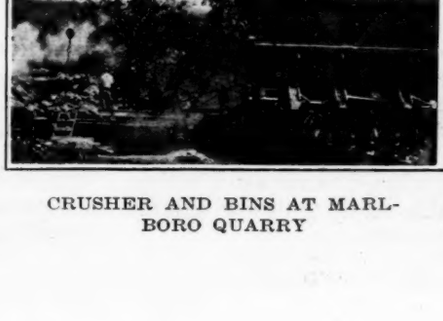
Quarries, sand pits, distribution of cement and aggregate by trucks and industrial railroad, moveable storage bins, pumping, concrete mixing, finishing and curing equipment.

About 8,000 yards of broken stone required for the concrete in the northern four miles of contract one were shipped from Hartford in railroad cars, run over trolley tracks to the freight yards in Glastonbury, where it was unloaded to storage by the Brownhoist locomotive cranes. The remainder of the 16,000 yards of 1½-inch broken stone, the larger stone required for Telford foundation and a small aomunt used for drains or culverts, walls and miscellaneous purposes was local stone, quarried by the contractor at Marlboro or gathered near the road alignment. Where satisfactory material was found desirably located, the property was purchased or leased and the rock taken out, crushed and transported to the general storage bins and piles at an average total cost of about $4.00 per yard.

There were two quarries, one at Marlborough Four Corners near the south end of contract No. 1 and one at New London, the south end of contract No. 4.

The Marlborough quarry was a hillside ledge of trap rock with an approximately level floor at grade and a face 150 feet long and from 40 feet to 60 feet high, from which the rock was easily thrown down by drilling and blasting. It was handled with scale boxes and with chains to the Farrel crusher, and broken to 2½ inches at the rate of about 100 tons per day, elevated by a bucket conveyor to a cylindrical screen about 30 feet above the ground, mounted over a 35-yard storage bin, from which the

*Part 1—General description grading, unloading and storing aggregate and cost of handling broken stone was published in the January 14th issue.



CRUSHER AND BINS AT MARLBORO QUARRY

CRUSHING AND SCREENING PLANT AT NEW LONDON QUARRY

broken stone was delivered through three vertical sliding steel gates and spouts to automobile trucks.

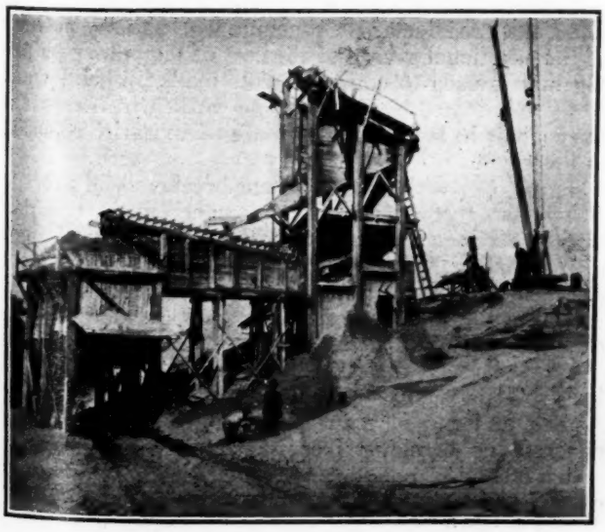
This quarry was operated to keep the 35-yard storage bin filled and was run steadily for about five months with an average force of 18 men turning out a total product of about 8,500 yards, which could have been greatly increased if convenient storage had been larger or if the consumption had warranted it.

The New London quarry, opened in 1920, before beginning road construction, has furnished this year more than 16,000 yards of granite, produced by an average working force of 15 men. It was opened with a circular pit about 40 feet in diameter and 15 feet deep, and has been worked on all faces extending the excavation to correspond roughly with the area commanded by the 80-foot boom of a guyed derrick, which serves it and delivers the rock in scale pans to the 13x14-inch Farrel crusher.

The present shape of the quarry pit is roughly a crescent in plan, extending about 200 degrees around one side of the derrick mast and having concave sides worked back farther than the convex side from the original pit, beyond the radius of the boom, permitting a greater quantity of rock to be thrown down from it, within easy reach of the derrick. The drilling is done with three Ingersoll-Rand drills and the product of the crusher is delivered to the Good Roads elevator, discharging through a circular screen on top of the 50-yard hopper-bottom bin, from which the product is spouted to industrial cars or trucks.

A small amount of rejects from the crushers are returned and broken to 2½ inches, except a small amount that are reserved for Telford foundation and for culverts and drains. The stone dust, amounting to about 25 yards per day, is used on the road shoulders.

When the work was most active the cars operated to their fullest capacity with a total force of about 60 men working from 10 to 16 hours per day who produced a maximum quantity of 250 tons per day, thus enabling the quarry to produce within 2,000 yards of all the stone required for the south end contracts 3 and 4.



SAND-WASHING PLANT AND LOADING BIN. DERRICK COMMANDS SAND PIT

SAND PITS

About 4,000 yards of sand required for the first four miles at the northern end of contract No. 1 was imported, and about 7,000 yards used at the south end of contract 4 was also imported and delivered by water at New London. The remainder of the 30,000 yards of sand required for the entire work was produced locally by the contractor in several pits at different points along the work, so that in

½-YARD CLAM-SHELL BUCKET EXCAVATING SAND FROM OLD RAILROAD BORROW PIT AT COLCHESTER

some cases the haul on sand amounted to 12 miles in each direction. Hauling was done with 5-ton automobile trucks delivering the sand to storage in advance of the road construction. The principal pits were at Marlborough and Colchester. The former was operated by a derrick and clam shovel. The clean, sharp sand, which did not require washing or screening, was hauled by trucks at an average rate of about 200 yards per day. A force of only 2 teams and 5 men was required at this pit and the total output from it was about 4,000 yards.

The most important pit was that at Colchester, which supplied about 16,000 yards of sand for con-

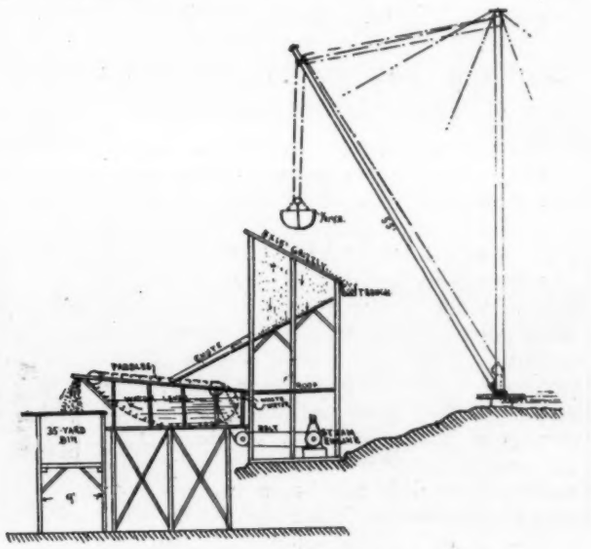
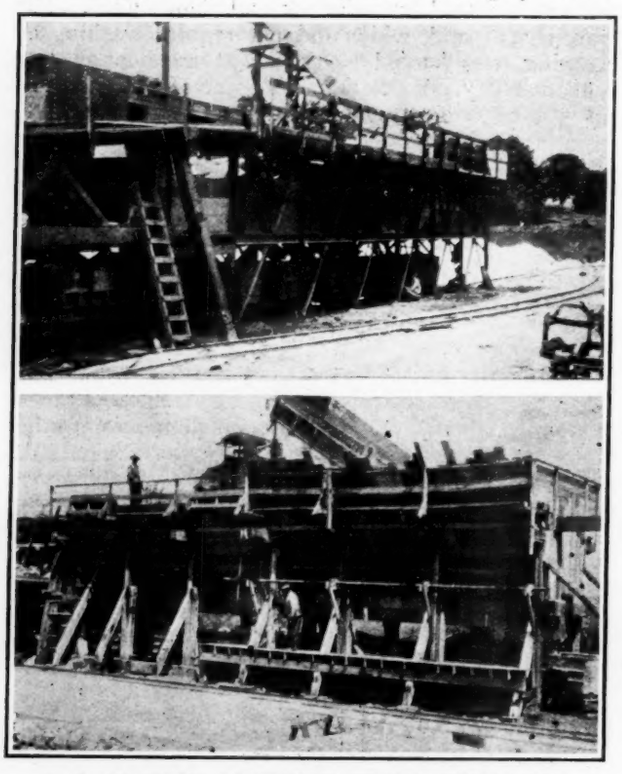


DIAGRAM OF SAND-WASHING PLANT

tracts 3 and 4, covering most of the south end of the turnpike. The pit was located near Colchester at about the middle of the 16 miles of road that was served by it. The sand was excavated by a 1-yard clamshell bucket, operated by the 70-foot boom of a guyed derrick. As soon as the sides of the excavation receded from the reach of the boom, the sand was washed down a natural slope by a hydraulic jet provided with water pumped from a creek about 2,000 feet away and delivered under 125 pounds pressure through a 2-inch nozzle, the pumping being done by a duplex pump furnished with steam from a 50-h.p. boiler.

The clamshell bucket dumped the sand on a grizzly, elevated about 40 feet above the surface of the ground, where it was washed with four streams of water at about 50 pounds pressure through nozzles made by flattening 2-inch pipes. The rejects passed down the inclined surface of the screen to a wooden chute that distributed them to a waste pile. The fine material passing through the screen was carried by the waste water to an inclined trough lined with sheet iron that delivered it at the center of the 4x-foot wash box 18 feet long, made by the Good Roads Machinery Co. The box contains a pair of parallel full-length endless chains that are provided with transverse wooden cleats or paddles, corresponding to the buckets of an elevator. The lower parts of the chains travel below water level, following the horizontal bottom of the box part way and rising at the farther end over an incline upon which the paddles force a continuous stream of the coarser particles of washed sand and push them over the elevated lip of the box, whence they are discharged into the loading hopper. The agitation of the stream of water supplied to the washing box thoroughly cleaned the sand and floated off the dirt and smaller particles which escaped through the overflow at the rear of the box, the height of the overflow being regulated to determine the amount and fineness of the sand that it saved. The overflow gate is of a special type furnished by the manufacturers of the machine and regulated by a hand wheel.



8 x 6 x 50 FOOT PORTABLE STEEL STONE BIN
WOODEN SAND STORAGE BIN AT COLCHESTER

The sand washing machine is installed in a wooden tower about 30 feet long and 7 feet wide, made with 10x10-inch vertical posts with sides, floor and roof of 2-inch planks. The paddles in the washing box are driven by a sprocket chain, operated by a belt from a 10-h.p. steam engine. The derrick is operated by a two-drum Lidgerwood hoisting engine; the wash water and the hydraulic jet water are furnished by a 14x8x13-inch Cameron pump with 5-inch suction and discharge pipes. The large amount of water carried over from the wash box with the sand makes it necessary to have an exceptionally tight hopper bin from which the sand is chuted directly to trucks. The plant is operated with an average force of about 7 men, and although run at only about one half capacity, produces from 400 to 500 yards per day. Some of the sand from pockets in this pit was naturally of proper size and did not require washing or screening. About 10,000 yards have been washed in the season of 1921 when a total of 50,000 yards were excavated and used for the roadwork. The cost of producing sand and storing it in hopper bins varied from about $3.00 to $3.50 per yard, according to whether it was washed or not.

(To be continued)

Rapid Removal of Asphalt Pavement

The Pacific Telephone and Telegraph Co., Seattle, are now constructing a toll line project involving 25 miles of solid rock hole drilling that is being done by three men with jackhammers, operated by an Imperial portable air compressor, which also furnished air to operate the Ingersoll-Rand paving breakers, with which portions of the asphalt pavement on concrete base are removed at a cost of 9 cents per square foot, as compared with a cost of 28 cents per square foot when the work is done by hand.

The hand work is thus more than two and one-half times as expensive as the machine work, to say nothing of the additional saving of the cost of temporary planking that is used to cover the cuts made by hand work and is eliminated by the machine work, which removes the asphalt in large slabs that are temporarily replaced in the cut.

Three men with two pavement breakers will average 300 linear feet of asphalt pavement cut in one day against 80 linear feet cut by hand with a crew of eight men in one eight-hour day, the asphalt averaging from 3 to 6 inches thick and the concrete 6 inches thick.

The paving breakers are of rugged and durable construction, in which screw joints are eliminated and the shock is largely absorbed by springs. They use 1⅛-inch solid hexagon steels with chisel edges for cutting asphalt and a moil point for breaking or spalling the concrete or breaking frozen ground. The breakers weigh 58 and 68 pounds and are used with air pressures of more or less than 80 pounds respectively.

The Imperial type No. 14 portable compressor, which will operate two of the paving breakers, is of the vertical duplex water-cooled type, driven by electricity

or gasoline, mounted on a steel frame with broad tread steel wheels.

The outline of the section of pavement to be removed is laid out and "marked" by cutting holes 3 or 4 inches apart through the full thickness of the asphalt with the chisel edge of the breaker, thus practically enclosing the section of pavement with a groove. Transverse lines about 12 inches apart are laid out across the section and similar cuts are made in them, detaching rectangular pieces of asphalt about one foot in width, which are removed by hand, after which the chisel point is replaced by the moil point, and the latter is driven into the concrete in the center of the space, spalling off an irregular V-shaped section, the edges of which are broken off about 3 inches at a time on each side and the concrete removed in small pieces. The earth is loosened, if necessary, by the moil point, and the hole is excavated to the required depth.

Link in Bankhead Highway Completed

By R. V. Glenn *

Special integral concrete curb. Sliding dowels in expansion joints. Stone cars unloaded by tilting hoppers.

On November the thirtieth of this year, Tarrant County, Texas, formally opened to the public the east end of the Bankhead Highway in that county. This is one of the sixty-eight projects to be constructed under a bond issue of $3,450,000, voted in 1919, and is the first Federal Aid project to be completed in this county.

This particular section, 5.84 miles long, is a part of the main thoroughfare between Dallas and Fort Worth, and probably carries the heaviest traffic of any road in the state of Texas. The location is entirely new, and eliminates eleven main line grade crossings, four of which are double. The maximum grade is 3 per cent. There are but five curves in the project, none having a radius of less than 1,500 feet.

The drainage structures are of reinforced concrete. The project has one bridge of three 28-foot spans, with a very ornamental but easily constructed hand rail.

An unusual feature in reinforced concrete is the under-pass built in front of the Masonic Home for Old and Indigent Masons. This was deemed advisable on account of the high speed traffic at this point.

The drainage structures and all grading were completed under a contract with the Womack Construction Company of McKinney, Texas. The pavement was advertised and let under a separate contract, to the Tibbetts Construction Company, of Mineral Wells, Texas. The pavement is 21 feet wide, over all, 8½ inches thick at the center, and 7½ inches at the curb. It is reinforced with National Steel Fabric wire mesh, weighing 25.6 pounds per square.

* Consulting Engineer, Fort Worth, Texas.

CURBS AND JOINTS

An unusual feature of the design is the 4½x6-inch integral curb, so designed that traffic, in emergencies, can cross over it, yet will not voluntarily make it a common practice; the object, of course, being to confine traffic where it properly belongs, to the pavement, and to reduce the maintenance of the shoulders to a minimum.

The shoulders are sodded with Bermuda grass. The pavement surface is drained through pre-cast concrete outlets, grouted to the pavement, and placed at intervals of 100 feet on alternate sides of the pavement, thus providing an outlet every 50 feet. The surface water is carried from these drains to the bottom of the ditches by grouted rock drains.

Another unusual feature of the design is the method of putting in the construction joints, which were placed at the end of each half-day's run. Seven dowels, 11 inches long, and ⅝ inch in diameter, are set 3 feet apart in each joint, 5 inches of each dowel being inserted in a ¾-inch pipe, 6 inches long, and imbedded 4 inches deep at the end of the run. This prevents any buckling at the joint, yet permits of both expansion and contraction. Commercial elastic filler was used at each joint.

MATERIALS AND EQUIPMENT

The fine and course aggregates used were both shipped in. The sand, a hard, clean and well graded material, as brought in from a pit near Grand

UNDER PASSAGE ACROSS BANKHEAD HIGHWAY

Prairie—a distance of about eight miles. The rock came from the quarry of the Mineral Wells Crushed Stone Company and is all a hand picked, very clean, hard, durable limestone. The cement was obtained from the Texas Portland Cement Company at Dallas. All material was thoroughly tested before using.

The entirely new equipment for this project, purchased by the Tibbetts Construction Company, included a 14 foot L. C. Smith mixer, a Lakewood finishing machine, 1,200 feet of special design steel forms, 600 feet special design steel curb forms, 12 Ford trucks equipped with Lee bodies, pumps, hose, etc. Actual construction of pavement started in June, 1921, and the lay-out for the work was very

carefully planned. Two unloading switches were so located on the Texas & Pacific Railway as to provide a maximum haul of three-quarters of a mile.

The rock was unloaded by hoppers holding exactly 12 cubic feet. They were so arranged as to hook on the side of the loaded gondolas and were slightly unbalanced, the heavy end being on the inside of the car. Long handles attached to the hoppers rested on the opposite side of the car.

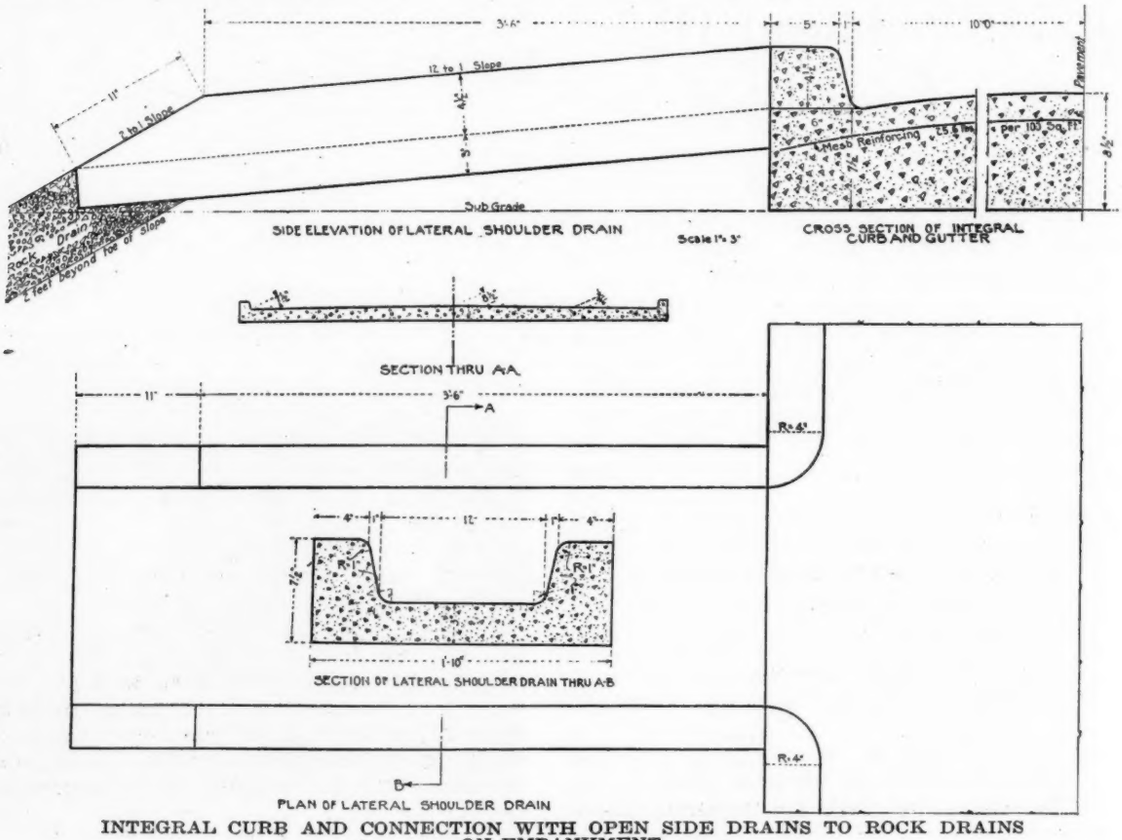
When loaded for dumping, a slight lift on the handle was sufficient to transfer the content to the waiting Lee dump bodies below, the hopper returning to its original position when empty.

The truck however, before taking the stone aggregate, passed first under a sand trap, receiving 6 cubic feet of sand; then passed the cement car, receiving 3 sacks of cement. The truck bodies were all carefully measured, and marked with white paint for the different aggregate content.

four inches of water for two weeks. The material from the dykes was then removed from the pavement to the shoulders, all of which were sodded in Bermuda. The finished road is excellent, and in its many details is the most complete piece of work of this character the writer has ever turned over to the public.

New Highway Construction Course at Pennsylvania State College

N. C. Miller, head of the Engineering Extension Department of Pennsylvania State College, announces that a training course in highway construction has just been prepared for home study by the Engineering Extension Department and can be attained by registration with the Department, so that the course can be completed before construction begins in the Spring, either by home study or by



INTEGRAL CURB AND CONNECTION WITH OPEN SIDE DRAINS TO ROCK DRAINS ON EMBANKMENT

The truck then proceeded to the mixer, passing over a turntable which was kept continually just ahead of the mixer. It then backed to the skip, the contents were dumped by one man, and the operation repeated.

The water content was kept as low as the finishing machine could handle and tamp the mix. It was found that for this thickness of pavement, a wetter mix was necessary for a machine finish than for a hand finish. It was also determined, at least to the satisfaction of the writer, that the pavement as placed, 8½ inches thick, was just about as heavy as this particular finisher could handle in one course.

Every foot of the pavement was ponded under

night classes, thus especially adapting it to the needs of men now engaged in highway construction or maintenance so that they can utilize their spare hours. The examination papers will be handled as if the participants were actually on the college campus, and the instruction will include every possible kind of road and highway work.

Wage Cut In Massachusetts.

On December 14th the Associated Contractors for Massachusetts with a membership covering the entire state, voted that wages in the building industry must be much lower in 1922, and that they would not sign any written agreement with the unions or permit the latter to dictate working conditions.

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CONTENTS

Objections to the Imhoff Tank

The Imhoff tank has succeeded the septic tank as the most popular type of sewage treatment in the United States and several score of installations of such tanks are now in operation in this country. However, not all engineers are convinced of the general superiority of this tank over other types of construction for tank treatment.

Although nearly forty Imhoff tanks are to be found in the state of New Jersey (or perhaps some would say *because* of the existence of this number, certain engineers at least of the New Jersey state board of health are not favorably inclined toward the Imhoff tank and believe that equally as good if not better results can, in the majority of cases, be obtained by single-story tanks, which can be both constructed and operated at less cost. In this issue we begin the publication of an article by Russell Riker, assistant sanitary engineer with the New Jersey health board, which will be continued in three or four issues of the paper. This week's installment presents the views of the writer as to the Imhoff tank, which we suppose may be considered as the views of the department, although it is not officially given out as such.

According to the author, Imhoff tanks are not now in such good favor even in Germnay as they were a few years ago. The greater construction cost is undisputed, and Mr. Riker presents figures to show that the operating costs also are greater than for treatment in other types of tanks. In addition, he cites difficulties which have been found more or less generally in the operation of such tanks, notably that caused by foaming.

The article is given as representing the ideas of Mr. Riker personally and publication by us does not imply endorsement of all of his views. It seems desirable, however, to have them brought prominently forward in order that the objections entertained by some engineers to certain of the features may be more generally known, and also with a view to a discussion of these points. We will be glad to receive and publish comments upon Mr. Riker's statements by other engineers either endorsing or controverting them, and our columns are open for this purpose.

Serious Pollution of Streams

A few weeks ago we presented facts and figures from a paper by Kenneth Allen tending to show that the pollution of New York harbor had already reached a dangerous point, and in fact had passed it at certain portions of the waters surrounding Manhattan borough, where the dissolved oxygen was found to be less than 10 per cent. or 15 per cent. of the saturation figure and at certain times to be entirely absent. Recently the Pennsylvania state board of health has called to the attention of the City of Philadelphia that the Delaware river, which forms much the largest part of its waterfront, is in practically the same condition, certain of the tests for dissolved oxygen showing none present.

While the entire absence of dissolved oxygen in each of these bodies of water is only occasional and at certain points, comparison with past figures shows that the condition is becoming continuously worse in this respect, and when the frequency and duration of such conditions increase, a nuisance which will be evident to the senses will inevitably occur. Each of these cities has thus had a most definite and indisputable warning given it that it should at once complete plans and carry out constructions and methods which will tend to reduce the pollution of the waters by its sewage which has contributed most largely to this result.

While these are perhaps the most advanced cases of pollution, there are other streams and bodies of water which are rapidly approaching a similar undesirable condition, notably some of the streams in the northern part of the Mississippi valley basin.

The elimination or even the diminution of these serious conditions involves the expenditure of large sums of money and is not to be undertaken lightly and naturally will not be undertaken at all until the communities become convinced of the necessity in order to preserve their own comfort and health or

until they are required to do so by the state or federal government in order to preserve others from the effects of their acts.

Unfortunately the general public cannot easily be persuaded of the imminence of such undesirable conditions until their own eyes or noses show them that the nuisance has already begun, and as it requires several years to design and carry out the features necessary to prevent such nuisances, they are almost certain to become very pronounced before such works can be completed. In spite of the difficulty of arousing public opinion to a sufficient foresight in this matter, it is the duty of engineers and other officials connected with public health and sanitation to keep everlastingly at a campaign of education designed to bring about a sufficient enlightenment of the more intelligent taxpayers to make it possible to advance, if only by a year or two, the actual undertaking of the works necessary for this purpose.

Public Works in 1921

In the F. W. Dodge Company's review of building operations for the year of 1921 figures are given to show that the amount spent throughout the country for public works and utilities was only second to that used in constructing residences, which latter was 54 per cent. greater than in 1920. The total for public works and utilities is given as $459,184,000.

By districts, the figures for the total expenditure for public works and utilities, and the per cent. each was of the total spent for all kinds of construction in the district, are given as follows:

In New England the total for public works was only 9 per cent. of all expenditures, being $18,973,000. In New York state and northern New Jersey, also, the percentage for public works was small, being 7 per cent. of the total or $45,598,000. In the middle Atlantic states, however, the amount spent for public works was 25 per cent. of the total, being exceeded only by residential expenditures, and amounting to $88,337,000. In the Pittsburgh district, public works took an even higher place, $117,259,000 having been spent, or 28 per cent. of the total construction expenditure, or only about $3,000,000 less than that spent for residences. In the central west, public works lead the residential buildings with $165,801,000 or 27 per cent. of the total construction expenditure. In the northwest the amount devoted to public works was $23,216,000, or only $750,000 less than residential buildings, and 27 per cent. of the total expenditure for construction work.

The forecast for 1922 is that, considering the remarkably good showing for the month of December following the good records of the four previous months, "this year will see a measurably larger volume of construction than the program carried through in 1921." The effort will be toward the expenditure of $4,000,000,000 for the entire country, but the supply of materials, labor and transportation facilities is still inadequate to carry through such a large program. "It is neither likely nor desirable that a program of such magnitude be actually started. Slowness of recovery in general business, labor disputes still unsettled and other retarding factors may be expected to curb a too rapid boom in construction."

Constructing Crystal Lake Sewers

During the Summer of 1921 the E. R. Harding Co., of Racine, Wis., contractors, excavated more than 60,000 linear feet of sewer trenches at Crystal Lake, Ill., in soil composed entirely of sand and gravel with a large amount of boulders from 1 to 4 feet in diameter. The work was done in five months with two Parson's No. 36 gasoline machines, designed to dig a trench 36 inches wide and 15 feet deep and usually operated by five men each, namely—an operator, foreman, pipe-layer, tender and one extra man. The backfilling was accomplished by a Parsons gasoline-driven backfiller machine following the excavator.

Although the material encountered was somewhat loose and unstable, there was little sheeting required for the trenches because the latter were made very wide on top. Although this involved the excavation of a larger amount of material, it could be handled more easily than to excavate less material in a minimum width trench and thoroughly sheet and brace it.

In one of the contracts where the trench was excavated 20 feet through sand, the sides would not stand up as well as in gravel and light bracing was required.

In some cases the gravel was so coarse that it could not be handled by the buckets at first, and continuously rolled back alongside the digger, especially in the deep cut where the inclination of the bucket ladder was very steep. Lengthening the ladder to 20 feet so as to decrease the slope enabled the buckets to handle the gravel satisfactorily .

Where the trench was 17 or 18 feet deep it was 12 feet wide on top, necessitating the use of an extra long conveyor and an additional man at the top of the spoil bank to push the earth back. The same contractors in 1920 excavated 40,000 feet of sewer trench at Libertyville, Ill., in 100 working days.

Pittsburgh Wages

In Pittsburgh wages were quoted for December 1st of $1.00 per hour for carpenters, hoisting engineers, stone cutters, stone masons, structural iron workers, plumbers, sheet metal workers and a number of other trades. The highest wages were $1.30 for bricklayers and $1.12½ for plasterers. All classes received 1½ time for overtime on week days and double time for overtime on Sundays and holidays.

American Engineer Decorated

Dr. J. A. L. Waddell, consulting engineer, bridge expert and author, on December 3rd was decorated by order of the Prince Regent with the Second Class Order of Merit of the Sacred Treasure, in recognition of his services to the engineering profession in Japan, where many years ago he was a Professor in the Imperial University, and for his prominence in engineering education and assistance to Japanese engineers. Dr. Waddell has finished his professional engagement in China and on December 11th sailed from Kobe for the United States by way of the Suez Canal.

Emmetsburg–Mallard Highway

Aggregate for eleven miles of road stored in advance at central point and distributed by industrial tracks and batch boxes. Abundant equipment insured good steady progress.

Federal Aid Project 109 in Palo Alto county, Iowa, is a concrete highway 18 feet wide, 7 inches thick at the edges and 8 inches thick at the centre, which extends south 11.05 miles from Emmetsburg to Mallard, following an old alignment through a gently rolling country, crossing the Des Moines river. The alignment is nearly straight with about 300 feet of a maximum grade of 4 per cent. The construction involved the excavation of about 40,000 yards of gumbo and loam, which was handled with plows and scrapers, and the placing of 115,000 square yards of concrete mixed in a Koehring 21-E paving machine with full caterpillar traction.

The contract was awarded to Brereton & Brauck, Emmetsburg, Iowa, at a price of about $8.00 per linear foot. Work was commenced August 21, 1920, and completed October 5, 1921, with a maximum force of about 65 men and an average force of 50 men, working 10 hours per day and receiving wages of $.50 for labor and $.60 to $1.00 per hour for machanics, thus developing a payroll of $2,000 to $2,500 per week.

The aggregate used was run-of-pit gravel, dug on the bank of the Des Moines river at a point a mile or two west of the north end of the highway by means of a Sauerman dragline cableway excavator. It was transferred from the stockpile at the gravel pit over an industrial track laid alongside the road to the middle point of the latter, where there was established during the winter of 1920-1921 a 14,000-yard rehandled stockpile.

At the rehandled stockpile, aggregate was loaded by a Barber-Greene machine into 120 Koppel wooden tipover batch boxes of 22 cubic feet capacity. These were loaded in pairs on 64 Koppel road builders' cars and hauled by four Whitcomb 6-ton gear-driven gasoline locomotives over 6¼ miles of 24-inch portable tracks laid alongside the highway from the rehandled pile north to Emmetsburg, thus providing for the delivery of materials to the mixer until the road was constructed from Emmetsburg to the rehandled pile, when the tracks were taken up and relaid from the rehandled pile south to the Mallard end of the road, thus providing for the construction of the whole line with 6¼ miles of track.

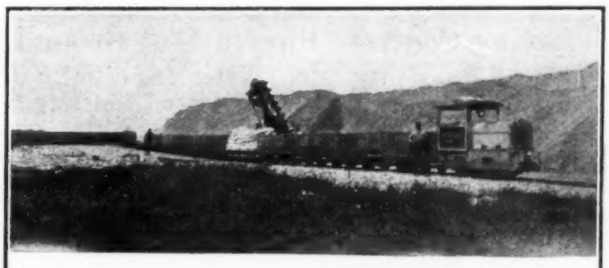
Water was supplied by a Koehring-Gardner steam pump, which with its boiler was mounted on a steel truck and moved from point to point to different supplies, from which it delivered through a maximum of 15,000 feet of 2-inch pipe.

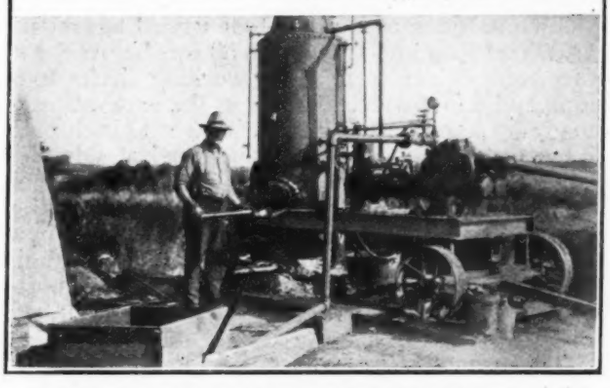
The surface of the ground was finished by a Lakewood subgrader, a 10-ton Kelly Springfield roller and a pressure scarifier.

The paving machine was followed by a Lakewood road finishing machine operating on the Heltzel steel forms of which 2,000 linear feet were provided.

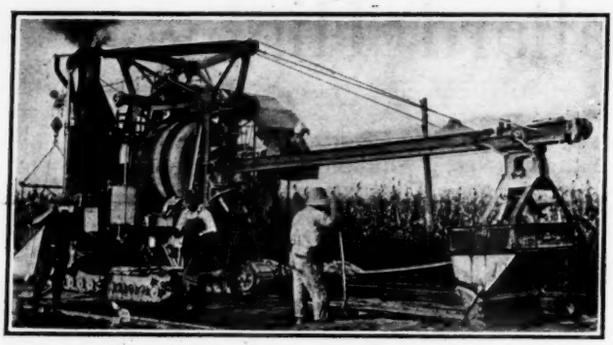
The concrete was mixed with 1.93 barrels of cement per cubic yard, and was placed at a uniformly rapid rate, the best record for one day being 1,075 square yards in eight hours and 1,346 square yards or 673 linear feet in one 10-hour day. The best month's run was 19 10-hour days in the month of August, when there was made a progress of 10,934 linear feet or 21,868 square yards of concrete. During construction, local traffic was detoured to the adjacent fields and through traffic was by-passed around the section, detour signs being posted at all turns.

Fresh concrete was protected with canvas and





TRAIN OF BATCH BOXES AT REHANDLED STOCK PILE
LOADING AGGREGATE FOR TRANSPORTATION TO MIXER
PORTABLE STEAM PUMP SUPPLYING PAVER



21 E KOEHRING PAVER SUPPLIED BY BATCH BOXES

afterwards covered with 2 inches of earth kept wet for 14 days. Trucking was done with one Winther-Marwin 1½-ton 4-wheel drive truck and one 1-ton Ford truck and two 1½-ton Troy trailers. The work was executed under the direction of J. L. Geils, resident engineer.

Laying Concrete Pipe in Soft Ground

The Kansas City, Mo., Water Department has recently laid 9,585 feet of reinforced concrete bell and spigot pipe 58 inches in exterior diameter, under difficult conditions where ingenious methods were developed. The 648 pieces of pipe were cast in sections 12 feet long that weighed 5½ tons each and were handled in the casting yard by a 90-foot steel derrick boom and were hauled to the site over very soft, wet ground by a 10-ton crawler tractor, dragging a 4x16-foot steel-bottom platform with a 24-inch wheel 3 feet long at the rear end, on which the pipes were loaded.

A 7½-foot trench 12 feet in maximum depth was excavated just in advance of the pipe laying by a steam shovel operating at the rate of about 75 linear feet per day. The pipe sections were lowered into the trench by a travelling derrick spanning the trench and the joints were pulled tight by a clamp attached to the last laid pipe and to the new section forcing the latter up against a lead gasket in the bell, after which the joint was completed with cement mortar, trowelled, and the trench was backfilled by machine.

Two sections of 7 x 7½-foot tunnel aggregating 1,800 feet long and from 15 to 30 feet below the surface were driven from seven working shafts 16 feet long and 8 feet wide. As fast as the excavation was made by hand it was lined with 3 x 12-inch planks 7 feet long, the bottom, top and vertical side pieces being successively placed, and the top piece being temporarily secured by screw end braces until the vertical side pieces were inserted between it and the bottom piece and held by short longitudinal cleats nailed across the ends of the top and bottom pieces. The work was done in three 8-hour shifts of 9 men each.

The tunnel was 6½ feet wide in the clear, leaving a clearance of only 10 inches on each side of the pipe, which was delivered on a 12 x 12-inch fixed horizontal cantilever projection from a counterbalanced narrow gage car hauled in and out by a 4-horse power gasoline engine mounted on the car that was also used to lift the pipe.

The pipe was set on 3-inch blocks and a bed of concrete 2-feet wide was placed under the pipes to distribute the load on the bottom of the tunnel.

The tunnel was backfilled with the earth from the spoil banks delivered by teams and slipscrapers to special shafts 50 feet apart, from the bottom of which it was distributed to place by hand. The work was so well done that the ultimate test under 30 pounds pressure showed a leakage of only 21.63 gallons per minute after the pipe had been 10 days in service.

Waterway Development in France

Since the return of Alsace and Lorraine to France, efforts have been made to complete the system of navigable waterways which link up these provinces with the main arteries of French navigation. Considerable improvements have been made in the Rhone-Rhine canal, to facilitate the movement of raw materials and manufactured products of Strassburg toward Lyons and the Mediterranean and vice versa. Work is also progressing on the Marseilles-Rhone canal, which was begun in 1911 and will probably be finished in 1925, the greatest difficulty in construction being furnished by the tunnel through the hills at Marseilles, which is said to be the widest in the world, measuring 72 feet from side to side. This tunnel is 45 feet high and provides for a depth of water of 13 feet and is 4-3/8 miles long.

Plans have been elaborated for utilizing the hydraulic power of the Rhone, the two principal features of which are, first, to utilize the river to the utmost for hydraulic power, irrigation and navigation and, second, to create a single corporation of public and private enterprises benefitted by this use of the river, with the state guaranteeing the finances and after a certain time sharing in the profits.

It is expected to locate 18 power stations along the 326 miles of the Rhone from the Swiss frontier to the Mediterranean. It is calculated that the total energy of the river at mean water is 1,800,000 h.p. and that the cost of carrying out the enterprise will be approximately 3,400 million francs. Projects are also being considered for increasing the transportation capacity and water supply of the canal connecting the Marne with the Rhine, and the extension of the Moselle canal above Metz in the iron ore district; also to extend and increase the transportation capacity of canals in the center and south of France at an estimated cost of 500,000,000 francs.

Philadelphia's Pollution of the Delaware

The State Department of Health of Pennsylvania has sent a warning to the city of Philadelphia that it is seriously polluting the Delaware river with its sewage, and urging it to treat all its sewage or at least a much larger percentage than is now being treated.

Examinations of the river water made last September showed almost complete exhaustion of the oxygen in some of the samples. Shad no longer come up the Delaware river for spawning and the shad fisheries at Gloucester have been destroyed.

Apparently the only way to avoid the transformation of the river from an asset to the city to a liability and a nuisance is to install sewage disposal plants, plans for which were made and approved in 1915.

Recent Legal Decisions

DISCRETION OF CITY COMMISSIONERS AS TO PAVING STREETS CANNOT BE RESTRAINED BY COURT OF EQUITY

The North Dakota Supreme Court holds, Hufford v. Flynn, 182 N. W. 941, that a court of equity cannot properly interfere with, or in advance restrain, the discretion of a board of city commissioners, while such board, in the exercise of powers conferred by the charter or general laws, is considering a proposition as to whether certain streets and alleys in the city are to be paved.

DISCRETION OF CITY AS TO LOCATION AND SIZE OF SEWERS

The Georgia Court of Appeals, Harrison Co. v. City of Atlanta, 107 S. E. 83, holds that "the duties of municipal authorities in adopting a general plan of drainage, and in determining when, where, and of what size and at what level drains or sewers shall be built, are of a quasi judicial nature, involving the exercise of deliberate judgment and wide discretion; and the municipality is not liable for an error of judgment on the part of the authorities in locating and planning such improvements." The action was one for constructing a sewer with too small an eye, resulting in the flooding of a basement. "In determining the location of the sewer and the size of the eye thereof, the municipal authorities were exercising their public or governmental functions, and these were discretionary acts, and as long as an official public act can be upheld as being within the exercise of the discretionary power conferred by the charter the will of the legislative body is supreme, and the courts have no power to interfere."

INJUNCTION TO RESTRAIN OPERATION OF DISPOSAL PLANT OF INSUFFICIENT SIZE WHICH CAN BE ENLARGED

The Texas Court of Civil Appeals holds, City of Pittsburgh v. Smith, 230 S. W. 1113, that a municipal corporation may be enjoined from maintaining and operating a sewage disposal plant or tank too small to accommodate the sewage flowing into it, so that the overflow from the plant pollutes a stream, where the plant can be so enlarged or added to as to abate or stop the continuance of the nuisance. "In operating a sewer the city exercised a corporate power, as distinguished from a governmental function." The court distinguished the cases relied on by the city as having no application to a structure that could be enlarged or added to so as to abate the nuisance alleged and proved here.

TAXATION OF MUNICIPAL WATERWORKS OUTSIDE CITY LIMITS

The Supreme Court of Vermont holds, Town of Orange v. City of Barre, 115 Atl. 238, that where a city is empowered by its charter to take water for domestic, sanitary and general industrial uses beneficial to the public and for protection against fire, and the entire water system is no more than sufficient to provide the city with an adequate supply, the system is within the provisions of the statute relating to exemptions from taxation of property used for public purpose. G. L. 684. But under G. L. 688, the land acquired by a municipality outside its territorial limits is not exempt. This, however, does not apply to reservoirs or aqueducts, nor to water supply, pipe lines, apparatus, machinery or improvements on such land, in any way connected with the maintenance or operation of such reservoir or aqueduct. These are exempt to the same extent as if they were acquired by the municipality within its territorial limits. The fact that, at certain seasons of the year, more water is supplied by the water system than is required for its municipal purposes, which is sold by the city for mechanical uses, does not deprive the property of its character as property used for a public purpose.

MUNICIPAL CONTRACTOR HELD ENTITLED TO RECOVER DAMAGES CAUSED BY BAD FAITH OR INEXCUSABLE IGNORANCE OF ENGINEER

Although a municipal contract provides in effect that the contractor shall be subject to the orders of the engineer and to the construction he gives to the plans and specifications, that does not mean that he has no recourse where bad faith or inexcusable ignorance is shown by the engineer resulting in damage to the contractor, First Savings & Trust Co. v. Milwaukee County, 158 Wis., 207, 148 N. W., 22, 1093. Such provisions imply that the engineer shall act in good faith, and that he is possessed of a reasonable degree of skill and care, and will in good faith exercise the same in giving orders and in performing his part of the contract. Where bad faith or inexcusable ignorance is shown to have resulted in damages to the contractor, who in good faith relied upon the directions of the engineer or upon the correctness of the work performed by him, then the contractor may recover the damage proximately sustained by him by reason of such bad faith or inexcusable ignorance. Nelson v. City of Eau Claire (Wis.), 185 N. W., 168.

LETTING OF CONTRACT—EXTENSIONS OF TIME FOR BIDS MUST BE ADVERTISED

Under the provisions of a city's improvement ordinances bids were to be advertised for and the contract let on August 1, 1914. At a regular meeting of the board of trustees, held on that date, it was reported that no bids had been received for the brick paving, nor for the construction of sewers, and the time for receiving bids was extended to August 1, 1914. Other than the sending of telegrams and the writing of letters by the city attorney and city engineer, nothing was done by the authorities between August 1st and 10th to advertise for bids for the contemplated improvements. There was no publicity given of the fact that there had been an extension of time for the reception of bids. The Court of Appeals of Kentucky holds, Preston Land Co. v. Town of Paintsville, 234 S. W., 445, that, under Ky. St. §5706, requiring street improvement contracts to be awarded, by cities of the sixth class, to the lowest bidder after advertisement, a property owner was not liable on an assessment for the cost of the improvement constructed under a contract awarded August 10.

NEWS OF THE SOCIETIES

CALENDAR

Jan. 24-26—ILLINOIS SOCIETY OF ENGINEERS. 37th annual meeting. Decatur, Ill.

Jan. 27 — NEW YORK SECTION, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Engineering Societies' Bldg., New York City. Secretary—G. I. Rhodes, 115 Broadway, New York City.

Jan. 27-28 — WESTERN PAVING BRICK MANUFACTURERS' ASSOCIATION. Kansas City, Mo.

Jan. 27-28—ARKANSAS CHAPTER, A. A. E. Little Rock, Ark.

Jan. 30—SOCIETY OF AMERICAN MILITARY ENGINEERS. Washington, D. C.

Jan. 30-Feb. 1—NATIONAL CIVIC FEDERATION. 22d annual meeting. Hotel Astor, N. Y. C.

Feb. 4-11—ST. PAUL BUILDING EXCHANGE EXPOSITION. St. Paul, Minn.

Feb. 12-17 — CONFERENCE OF HIGHWAY ENGINEERING, 8th annual conference. University of Michigan, Ann Arbor, Mich.

Feb. 13-16—AMERICAN CONCRETE INSTITUTE. Annual Convention, Cleveland. Secretary, Harvey Whipple, 814 New Telegraph Bldg., Detroit, Mich.

Feb. 14—ENGINEERING SOCIETY OF BUFFALO. Iroquois Hotel, Buffalo. Secretary—N. L. Nussbaumer, 80 W. Genessee St., Buffalo.

Feb. 15-17—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Tenth midwinter convention. Engineering Societies' Bldg., New York City.

Feb. 21-22 — KENTUCKY ASSOCIATION OF HIGHWAY CONTRACTORS. Annual meeting, Louisville. Secretary, D. R. Lyman, 523 Court Place, Louisville, Ky.

Feb. 21-23 — MINNESOTA FEDERATION OF ARCHITECTS AND THE MINNESOTA SOCIETY OF CIVIL ENGINEERS. First annual convention, Curtis Hotel, Minneapolis.

Feb. 22—AMERICAN BUILDING EXPOSITION. Municipal Auditorium, Cleveland, Ohio.

Apr. 19-21 — TRI-STATE WATER AND LIGHT ASSOCIATION OF THE CAROLINAS AND GEORGIA. Spartansburg, S. C.

Apr. 27-30—BUILDING OFFICIALS' CONFERENCE. Apr. 27-28, Cleveland, O.; Apr. 29, Massillon, O.; April. 30, Youngstown, O.

May 15-19 — AMERICAN WATERWORKS ASSOCIATION. Annual convention. Philadelphia, Pa.

June 4-6—AMERICAN ASSOCIATION OF ENGINEERS. 8th Annual Convention. Salt Lake City, Utah.

NEW YORK SECTION AMERICAN SOCIETY OF CIVIL ENGINEERS

'At the regular monthly meeting January 11th, the subject was "Traffic Handling—Its Engineering as Well as Regulatory Aspects."

The topic was presented by E. P. Goodrich and Amos Schaeffer, and was discussed by:

Robert Grier Cooke, president of the Fifth Avenue Association, which has made exhaustive studies of traffic in the Fifth Avenue section;
New York.

Dr. John A. Harriss, Special Deputy Commissioner of Police, in charge of traffic regulation for the City of New York;

Clifford M. Holland, Chief Engineer, New York State Bridge and Tunnel Commission and New Jersey Interstate Bridge and Tunnel Commission, which have made traffic studies to determine location and details of the tunnel entrances and exits;

And by A. T. Warner, Traffic Engineer, Public Service Railway Company, Newark, N. J., who considered the interrelation of electric railway and vehicular traffic.

AMERICAN CONCRETE INSTITUTE

Tentative program of convention at Hotel Winton, Cleveland, February 13-16.

February 13: Meeting of chairmen of all committees to discuss future work of the institute. Report of Committee S 6 on Concrete Roads. Presentation and discussion of revised standards. Discussion of Plant and Material Handling Problems.

Evening: Report of Committee S 5 on Reinforced Concrete Houses, New Building Regulations. Papers and addresses by two or three builders of Concrete Houses—no theory—no guesswork—no untried conjectures—actual experience on how it is being done. One of these addresses will be by Miss-Kate Gleason, Rochester, N. Y., whose concrete houses are close to the hundred mark—*all sold—at a profit.*

February 14: Report of Committee E 3—Research; a survey of important research which is being undertaken by various agencies and of research for which there is need. Presentation of the Wason Medal. Announcement of the work of Committee G 3 on Form of Standards. Business session. Report of Committee P 1 on Standard Concrete Building Units (New Standards for Block, Brick and Structural Tile). Report of Committee P 5 on Fire Resistance of Concrete Building Units. Report of Committee P 4 on Concrete Staves (special reference to strength and testing).

Evening: Report of Committee J 2 on Concrete Pipe. Report of Committee P 7 on Concrete Pipe, Drain Tile and Conduit. Report of Committee P 6 on Products Plant Operation, leading a general discussion of plant layout, equipment and operation problems.

February 15: Engineering Design and Inspection. Report of Joint Committee on Concrete and Reinforced Concrete. The report will be discussed by major subjects, led by chairmen of local committees of contractors from New York, Boston, Philadelphia, Chicago, and elsewhere, and by chairmen of institute standing committees whose work involves a special consideration of subjects covered in various sections of the Joint Committee Report. The discussion will be centered chiefly upon: 1. Quality of Concrete—Proportioning, Mixing and Placing. 2. Details of Construction—Fireproofing and Construction Joints. 3. Waterproofing — Protective Treatments (special reference to Corrosion of Steel Reinforcement).

Business Session.

Afternoon: Continuing discussion of Joint Committee Report.) 4. Surface Finish. 5. Design with particular reference to Proposed Design Requirements on Cost of Construction.

Evening: An informal, social, get-together, with cider and doughnuts.

February 16: A study of Proportioning Materials and Consistency, Slump Tests, Test Cylinders. A demonstration of sieve analysis of aggregates, water control, slump tests and casting test cylinders as a means of relating laboratory knowledge of Field Methods. Report of Committee C 1—Contractors Plant. Report of Committee C 2, Concrete Floor Finish—Presenting Simplified Standard Specifications, followed by two brief papers on Special Floor Finishing Methods. Report of Committee C 3 on Concrete Surfaces. Changes in Stucco Practice, Exterior of Industrial Buildings, Special Decorative Effects, Interiors of Buildings, Bond of Applied Coatings. Report of Committee C 4 on Metal Forms. Paper on Repair of Concrete Ships. Paper: Graphic Determination of Stresses by Prof. George E. Beggs.

THE NATIONAL CIVIC FEDERATION

The Twenty-second Annual Meeting of The National Civic Federation will be held at Hotel Astor, New York City, Jan. 30-Feb. 1.

Among the questions to be discussed are:

Shall the United States Railroad Labor Board be abolished, be given more "teeth," be annexed to the Interstate Commerce Commission, be replaced by industrial courts along the line of the Kansas Court of Industrial relations, or

Does the voluntary principle, upon which is based the Four-Power Treaty dealing with international controversies, furnish a more effective method for handling industrial disputes?

Are all interests in industry better safeguarded by the shop representation plan or by the trade union plan?

Does collective bargaining conflict with the Sherman Anti-Trust Law or the various state laws prohibiting contracts in restraint of trade?

TRENTON ENGINEERS' CLUB

The Trenton Engineers' Club has elected the following officers: president, Harry F. Harris; vice-president, Edward E. Reed; secretary, Joseph E. English; and treasurer, James H. Johnson.

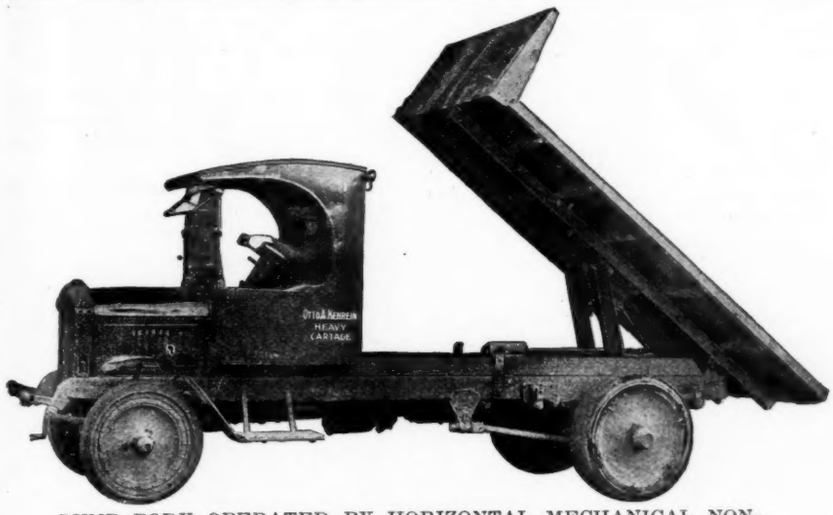
ASSOCIATED PENNSYLVANIA HIGHWAY CONTRACTORS

On December 15th and 16th the Associated Pennsylvania Highway Contractors held their Second Annual Meeting

(Continued on page 56)

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations



DUMP BODY OPERATED BY HORIZONTAL MECHANICAL NON-HYDRAULIC HOIST

PERFECT HOISTS

The Perfect horizontal-mechanical non-hydraulic hoists manufactured by the Perfection Hoist & Engine Co., are screw operated with power supplied from the truck transmission and controlled by a clutch controlled from the driver's seat. The mechanical action of the self locking screw enables the body to be elevated and locked at any angle up to 45 degrees where it is automatically sustained without danger of slipping, thus providing for road building where a spreading device is used or any other purpose where it is necessary to keep the body tilted for any length of time. No portions of the hoist project below the truck chassis. The self locking nuts support a patented equalizing device attached to the lifting cables. The nut travels on the screw operating the two cables, which raise the body or lower it by reversing the screw. The body is automatically stopped when reaching the full tilting angle or the original horizontal position.

The hoist is claimed to secure the use of full loading space on the truck chassis and allow the use of bodies from 12 to 24 inches longer, and with lower sides than bodies of equal capacity using the vertical type of hoist. The hoisting stresses are distributed over a length of 57 inches without concentration while the average vertical hoist distributes its strain over 18 to 24 inches.

The hoists are made in sizes of from 2 to 8 tons capacity; the number of working parts is reduced to a minimum; all parts is standardized and interchangeable; the efficiency is not impaired by cold weather; deep ruts and rough roads do not affect its operation, and it requires no oil, no pumps, no pipes and has no leaks.

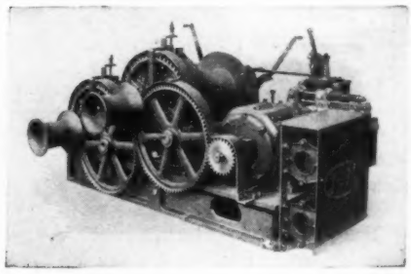
NEW P & H CONTRACTORS' HOIST

Pawling & Harnishchfeger Co., has standardized a line of contractors' stationary hoists, two illustrations of which are shown in the accompanying views. These hoists are made in types for electric, gasoline and belt drive, in sizes ranging from 8 HP. with 8x12-inch drum, up to 115 HP. with 18x29 inch drum. The long experience of the Pawling & Harnischfeger Company in building its own hoist drums, electric motors, controllers, and brakes used on its traveling cranes and monorail hoists has been drawn upon in the development of the stationary hoist line. For the gasoline-driven hoists, motors of the types that have been proven successful in P. & H. gasoline excavator-cranes, trench excavators, gas shovels and dragline excavators are used. These are in all cases of the heavy duty four-cylinder vertical tractor type with Bosch Magneto, Master Carburetors, Stewart Vacuum System and air cleaners. Automatic throttle governors are provided and conveniently located hand throttles.

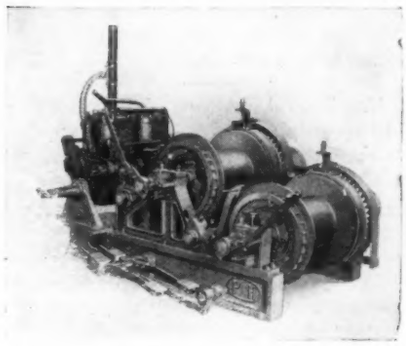
The same high quality electrical apparatus as furnished on P. & H. electric traveling cranes and hoists is used on all P. & H. electric driven contractors' hoists.

The belt-driven types are similar except that the rear end of the bed frame is left off, and a large size driving pulley is provided on the side opposite the operator. The construction for all types is similar—the bed plates and side stands are of box and I-beam section design with heavy cross girders and bottom and top flanging. Plates are accurately planed and side-faced. Through bolts only are used, and all holes are drilled in jigs and fixtures. All drum shafts are of high grade carbon steel, turned and ground to exact size teeth, and motor pinions and gears are hobbed. Drum gears are of solid web type with large hubs pressed in place on the shafts by hydraulic pressure against a shoulder.

The friction mechanism is of the standard V design; the friction blocks are of specially seasoned maple, accurately turned. Brakes are operated by means of foot levers located conveniently to the operator's feet. Full contact of the brake bands is insured because they are worked-in on drums and peened to conform to the drum surface before placing on the hoist. This is done so that the user does not have to wear the brakes in. Counterweights are provided for all brakes insuring a quick release.



TWO-DRUM ELECTRIC STATIONARY HOIST



TWO-DRUM GAS STATIONARY HOIST

INDUSTRIAL NOTES

The Combustion Engineering Corporation, New York, has opened a new branch office at 806 First National Bank Bldg., Pittsburgh, Pa., in charge of W. G. Stripe, formerly manager of the Philadelphia office.

The Portland Cement Association at its annual meeting re-elected as president L. T. Sutherland; first vice-president, Richard Hardy; second vice-president S. B. Newberry; and treasurer, F. W. Kelley.

The Orton & Steinbrenner Co. of Chicago manufactures locomotive cranes, clam shell and orange peel buckets and coal crushers, have made arrangements with Walter Hasendahl, 1213 Fuller Ave., Los Angeles, Cal., to represent them.

Acquisition of the Boonton Electric Company and the United Electric Company of New Jersey by the Morris and Somerset Electric Company, has been approved.

The Hogan Ditch Company has been incorporated by Robert Milne and Sievert O. Midland of Big Timber, at Big Timber, Mont., to build and operate irrigation ditches and plants.

John R. Alpine has been appointed New York department manager of the Grinnell Co., representing the company's power piping, steam, and hot water industrial piping interests.

The Associated Machinery Corp. has been formed by Pawling & Harnishchfeger Co., Novo Engine Co., Insley Manufacturing Co., Blaw-Knox Co., and the Chain-Belt Co., for the purpose of exporting construction equipment and other products of American manufacture to India, Burma and Ceylon.

The Osgood Company of Marion, Ohio, has recently opened a branch sales office in the Conway Bldg., Chicago, in charge of Arthur B. Sonneborn.

PERSONALS

Curley, James M., former mayor of Boston, was again elected mayor on December 13th.

Horr, B. L., was appointed county highway commisioner of Oneida county, Wis., to succeed Frank E. Parker.

Humeson, C. N., has been appointed city manager of Lufkin, Texas.

Manning, William B., of Michigan City, Ind., has been appointed city manager of that city.

Maier, Harry L., for 17 years engineer in charge of sewers for Wilmington, Del., has been appointed chief municipal engineer of that city.

Staley, P., has been appointed city manager of Fort Myers, Fla.

Fullerton, Howard R., formerly in the sanitary engineering division, U. S. Public Health Service, has been appointed assistant sanitary engineer for the Tennessee state department of health of disposal and water supply work.

Peterman, William T., highway contractor, St. Landry, La., has been appointed chairman of the Louisiana State Highway Commission.

Beebee, Ralph A., has been appointed chief harbor engineer by the Oakland, Cal., city council.

(*Continued from page 54*)

and Highway Construction Industry Conference at Harrisburg.

The slogan of the meeting was: "A dollar's worth of construction for every dollar of road bonds."

The first day was devoted to reports from the following committees: Legislative, specification, membership, labor, materials, transportation and publicity.

The Legislative Committee, Charles A. Waters, chairman, reported the passage by the 1921 Pennsylvania Legislature of four contractors' relief bills. The Governor signed one and vetoed three, due to doubtful constitutionality.

The Specification Committee, E. P. H. Harrison, chairman, emphasized the necessity of cutting down overhead expenses by elimination of risk in the various clauses. It was stated that from 10 to 15 per cent. of the cost could be saved for other construction. The suggestions are being presented to the State Highway Department for their consideration.

The Membership Committee, Wm. D. Hill, chairman, reported a growth for the year of 115 per cent. The number of members is close to the hundred mark and this list contains the names of the greatest road building firms in America.

The Labor, Material, Transportation and Publicity Committees reported on their successful activities for the year.

The following officers were elected: William D. Hill, Pittsburgh, Pa., president; Samuel M. Irwin, Philadelphia, Pa., first vice-president; Lea Hunt, Wilkes-Barre, treasurer; H. H. Wilson, Muncy, Pa., director 1922-23; Walter Rae, Pittsburgh, director, 1922-23; E. H. Shank, Erie, Pa., regional vice-president; Henry Baton, Philadelphia, Pa., regional vice-president; B. G. Coon, Luzerne, Pa., regional vice-president; J. C. Devine, Alliance, O., regional vice-president. Chas. F. Puff, Jr., was continued as secretary and general manager.

On December 16th the conference, with about 200 representatives from all branches of the industry, was opened by Mayor Hoverter of Harrisburg. All phases of road construction were discussed by the following speakers:

Bankers' Viewpoint, E. J. Stackpole, Director Harrisburg National Bank.

Surety Co's Viewpoint, Edward C. Lunt, Vice-President Fidelity & Casualty Co.

Cement Producers' Viewpoint, Wm. C. McIntyre, Atlas Portland Cement Co.; Ernest Ashton, Lehigh Portland Cement Co.; W. D. Cloos, Edison Portland Cement Co.

Coarse Aggregate Producers' Viewpoint, Wm. Beacham, General Crushed Stone Co.; Al. Hooker, Buffalo Crushed Stone Co.

Fine Aggregate Producers' Viewpoint, J. E. Carrell, J. E. Carroll Sand Co.; Alex. Dann, Keystone Sand & Gravel Co.

Asphalt Producers' Viewpoint, Wm. J. King, The Texas Co.; Louis Young, Atlantic Refining Co.

Mechanical Handling of Road Material, R. M. Gates, Lakewood Engineering Co., Edward M. Ornitz, Blaw-Knox Co.

Equipment Mfgs.' Viewpoint, H. P. Goodling, Galion Iron Works & Mfg. Co.; George Sherron, Koehring Company.

Penna. State Highway Dept., Howard Fry, Secretary, Highway Commission; John C. Hildebrandt, Comptroller; Chas. H. Moore, Traffic.

Publicity, R. K. Tomlin, Associate Editor, Eng. News Record; Wm. Jabine, Editorial Director, Successful Methods; W. S. Hays, Gen'l Secretary, Nat. Fed. Constr. Industries; Wm. C. Perkins, Eastern Pav. Brick Contr. Assoc.

The motif of the meeting was Wm. Penn's treaty with the Indians. Following the example of the founder of the great Commonwealth of Pennsylvania, all branches of the industry brought their problems to the conference.

Peace, harmony, confidence and good will marked the deliberations and closer co-operation with a reduction in highway construction costs should result.

At the banquet in the evening, Henry H. Wilson, the retiring president, acted as toastmaster. The other speakers were Lieutenant Governor of Pennsylvania, Edw. E. Beidleman; Daniel Garber, Organizer of A. G. C. of America; W. O. Winston, president of Associated General Contractors of America; William D. Hill, president-elect of A. P. H. C., and Chas. F. Puff, Jr., secretary and general manager.

ENGINEERING INSTITUTE OF CANADA, MONTREAL BRANCH

The Engineering Institute of Canada, Montreal branch, at its opening meeting presented a medal to Roger French for his paper, "Reinforced Concrete Covered Reservoirs." At the evening session A. E. Doucet presented the first of a series of papers to be given on the Montreal aqueduct, in which he outlined the whole waterworks scheme of the city.

WASHINGTON SOCIETY OF ENGINEERS

At its annual meeting the Washington Society of Engineers elected these officers: president, John S. Conway; vice-president, R. H. Dalgleish; secretary, A. C. Oliphant; and treasurer, O. B. Brench.

SAN FRANCISCO SECTION, A. S. C. E.

The San Francisco section of the American Society of Civil Engineers held its annual meeting on December 20th. The paper of the evening, presented by Charles Gilman Hyde, professor of sanitary engineering, University of California, was "The New Pumping and Filtration Works of the City of Sacramento, Cal." The following officers were elected: president, Thomas H. Means; first vice-president, Frank G. White; and second vice-president, G. A. Elliott.